tities ten times as great as strictly required for dissolving all the gold. I suppose that a sample of the pulverized quartz has been previously tested, a thing which will be always done.

Assuming that rich quartz, after being deprived of its coarse gold by sieving or sluicing, contains on an average one and a-half or two ounces of gold to the ton in a state of almost atomic division, the cost of chlorine, applied in quantity forty fold greater than absolutely needed for its solution, will be about two for every ton of quartz.

The accounts of the loss of mercury in that process are very variously stated at, from four ounces to one pound per ton of quartz. Suppose a pound were lost, it would be in value about two shillings. Now that would be about the cost of the requisite amount of chlorine for such treatment as that just described.

It must never be forgotten, that scarcely one-tenth part of the water used in the Chilian mill is required in this process —making it available all the year round in dry places.

It has sometimes been urged against chlorine, that it is a deleterious agent, but when we remember the extensive use made of it in Great Britain, for the purposes of bleaching, such an objection ceases to be heeded.

ART. XVI.—*Abstract of a Paper on the Yield and Uses of Volatile Oils, from Native and Imported Plants, in the Colony of Victoria.* By J. BOSISTO, Esq.

Having paid considerable attention to the medicinal plants of Victoria and their products, and of late more particularly to those producing Volatile Oils, I am induced to lay before this Society my notes and observations upon some of the latter, and also to direct attention to the probable advantages of cultivating European plants which produce Volatile Oils.

The term "oils" applied to products of this nature often conveys a wrong impression, few persons calling to mind the distinctive characteristic expressed by the term "essential" or "volatile." A true Volatile Oil leaves behind no trace of grease when dropped on the finest fabric, nor does it injure the most delicate colour. Such are, with one exception, the Essential Oils in question.

Volatile Oils, obtained from the leaves, branchlets, flowers, roots, or bark of trees or shrubs, by the ordinary processes of distillation, have up to the present never competed commercially with other vegetable products of a volatile nature. This has arisen either from expense of production, scantiness of yield, or limited quantity of accessible material supplying such oils.

The results of my late investigations justify me in asserting that the Volatile Oils of Victoria can compete advantageously with Volatile Oils and other volatile products from other countries.

At the late Victorian Exhibition I had the honour of exhibiting twenty-eight samples of Volatile Oils from native plants. The results of my own private experiments, made and recorded before the exhibition of these samples—which results were afterwards verified as correct by the extended investigations of the jurors—place many of them in a prominent position as valuable auxiliaries to some departments of manufactures, others as valuable additions to the pharmacopœia, and a few to the art of the perfumer.

The numerous genera and species of forest trees which abound in the colony primarily claim attention. And here I would say that I cannot too strongly express the obligations under which Dr. Mueller, the Government Botanist, has placed me, in common with all those who are on any account interested in the botany of Victoria, by his assiduous and untiring researches, and by the various able and valuable works in which he has embodied the results of his investigations ; nor should I personally feel justified in omitting to express my sincere thanks for the courteous kindness with which Dr. M. has always afforded me information on these subjects, and the readiness which he has always displayed to assist my inquiries.

Those trees and shrubs which, on account of their very extensive range, the unlimited supply of material, and the abundant yield of oil, are likely to be of especial value in the arts and manufactures, belong to the genera Eucalyptus and Melaleuca.

Those of value in therapeutics and pharmacy are numerous and varied, but our present remarks will be confined to those from which were produced the Volatile Oils exhibited.

Those of use to the perfumer will follow.

I have distilled from twelve species of Eucalypti, and

from five species of Melaleuca. Of the Eucalypti, the species most common within a few miles of Melbourne are *E. Rostrata, E. Odorata,* and *E. Viminalis.* In these, like all others of this genus, the leaves are the principal source of oil, the branchlets containing very little oil, the bark and roots none. The yield from these three species is very scanty. Experiments made at different periods of the year upon leaves obtained from the same locality gave results exactly alike. The following facts, however, will show that soil and position have something to do with both the quality and quantity of the product.

In experimenting on *E. Rostrata,* I found that the plants grown on high ground gave an oil of a dark amber colour, possessing an agreeable aromatic flavour, and having the aroma of carraways. The yield from 100 lbs. of the fresh gathered leaves was 1 oz. 6 drs. Specific gravity 0·918. Those grown on low and marshy soil yielded an oil of a pale yellow colour, in appearance and smell similar to that yielded by *E. Odorata,* the quantity being 9⅓ drs. to 100 lbs.

E. Odorata.

Leaves obtained from trees growing on elevated spots yielded 4 oz. 1⅓ drs. from 100 lbs., sp. gr. 0·922 : while leaves from low and swampy lands gave, from 100 lbs. only 5½ drs., sp. gr. 0·899. These oils were alike in colour and aroma, being both of a pale yellow, inclining slightly to green, and having a pleasant and agreeable, although somewhat camphoraceous, aroma.

E. Viminalis.

That obtained from the Botanic Gardens gave only a trace of oil, whilst that procured from the St. Kilda Park yielded half an ounce of oil from 100 lbs. of fresh leaves.

I find that Dr. Mueller states the range of these three species to be very extensive, so that the results here given cannot be considered final, as they were all obtained from trees growing within a few miles of Melbourne. The quantity of oil obtained from these species, although small, is not without interest, while they cannot, so far as we are at present able to judge, prove remunerative for any purpose ; yet the knowledge of these results directs us to other species.

I should observe that in all the Eucalypti the oil-cells can be made visible by means of transmitted light, and that a practised eye can determine the probable yield of oil by the greater or less degree in which the oil-cells are shown by

this means. Of all the Eucalypti the most remarkable in this respects is the

E. Globulus, or Blue Gum.

The oil-cells in the leaves are very large, more particularly those from young trees; but the supply of oil is greater after the leaves have changed from Obovate to Lanceolate, which is the case when the trees are from three to four years of age. The oil obtained is fine, clear, and limpid, pungent and diffusible to the palate, in odour approaching Cajuput, to which all oils from the Victorian Eucalypti have more or less resemblance. From 100 lbs. of fresh gathered leaves and branchlets I obtained 12½ ozs., sp. gr. 0·917.

This oil ranks foremost in value among those obtained from the Eucalypti, on account of its solvent powers, its illuminating properties, and its power of fixing the aroma of allied oils. The tree has an extensive range.

E. Oleosa, or Mallee Scrub.

This yields an oil very similar to the last described, and accordingly ranks next in value. The ease with which, at little cost, an abundant supply of this species can be obtained, renders it commercially more valuable than others yielding a larger amount of oil from the same weight of leaves.

The general appearance of the Victorian Eucalypti is that of forest trees, but this species seldom exceeds twelve feet in height, and is studded with foliage from top to bottom, forming, with other plants of the same and other genera, a dense scrub. From 100 lbs. of green leaves and branchlets I obtained 20 ozs., or one imperial pint of oil, sp. gr. 0·911.

E. Sideroxlyon, or Iron Bark.

This species is frequent in the vicinity of the gold fields, and on barren ranges. So closely does the oil from the leaves of this tree resemble that of *E. Globulus* and *E. Oleosa,* that when examined apart the difference would be scarcely perceptible in any one outward characteristic. The yield of oil from 100 lbs. of leaves was 16 ozs. 7 drs., sp. grav. 0·923. This amount must be taken as approximate only, as the leaves had lost some part of their oil by being heated in transport.

E. Goniocalyx, one of the White Gums.

Yields an oil alike in character to that of the three preceding, and ends one type of oils, viz., *E. Globulus.* From 100 lbs. of fresh leaves and branchlets I obtained 16 ozs. oil, sp. grav. 0·918.

E. Fabrorum, or Stringy Bark.

Yields a transparent reddish-yellow oil, milder in odour than those of the last type, in flavour resembling carraways and smoke essence combined, less pungent, but distinctly bitter. Yield from 100 lbs. fresh leaves was 8 ozs.

E. Fissilis, or Messmate.

In all respects like the last.

These two are powerful solvents, though not equal to the *Globulus* type.

E. Corymbosa, or Bloodwood.

The material from this species had suffered from close packing and length of time in transit, Dr. Mueller having obtained it for me from East Gipps Land. The yield from 100 lbs. of leaves was 9 ozs. 3 drs. of pure limpid oil, 6 ozs. 2 drs. of oil containing resinous matter in suspension. Supposing one half of this latter part of the yield to consist of resinous matter, the net amount of oil from 100 lbs. will be 12½ ozs. This oil possesses an agreeable perfume of a rose and lemon flavour, its taste is slightly bitter, but not so pungent and diffusible as others. Sp. gr. 0·881. The *E. Corymbosa* forms a type.

E. Woolsii, or Woollybutt.

Also from East Gipps Land. The oil is clear and colourless, much resembling an expressed oil, and possesses the remarkable property of imparting an indelible stain to paper, indicating that some peculiar substance is held by it in solution. Its sp. gr. bears out this supposition, being 0·940. Its taste is camphoraceous and aromatic, its odour like that of the melaleuca oils. Yield from 100 lbs. of leaves, 3 ozs. 3 drs.

E. Amygdalina, or Dandenong Peppermint.

Yields an astonishing amount of oil. From 100 lbs. of fresh leaves and branchlets I obtained three Imperial pints of oil, and this result was confirmed by repeated experiments. It is of a pale yellow colour, of a mild and cooling taste, and has the predominating camphoraceous odour, which last, however, disappears as the oil advances in age. Sp. grav. 0·881. Its solvent power is great, but not equal to the *Globulus* type. This species I attach to the *E. Odorata* type.

We proceed to the oil-producing species of the Melaleuca genus.

These species are not so abundant as the *Eucalypti,* but are sufficiently so to deserve consideration.

M. Ericifolia.

From 100 lbs. of leaves and branchlets combined I obtained 5 ozs. of a very limpid and almost colourless oil, partaking much of the Cajuput flavour. With age it improves greatly, and gives more of the aroma of the flowers. Sp. gr. 0.899.

M. Linarifolia.

Yields an oil of a light straw colour, having a slightly aromatic and pungent odour, and an agreeable taste, strongly suggestive of mace and nutmegs. The quantity yielded is large, 28 ozs. from 100 lbs. of fresh leaves and branchlets. Sp. gr. 0.903.

M. Wilsonii.

This shrub is a desert species. Yield from 100 lbs. of green material was 4 ozs., of a pale yellow colour, in odour slightly resembling *M. Ericifolia,* but devoid of its sweetness. Sp. grav. 0·925.

M. Genistifolia.

From 100 lbs. of leaves and branchlets I obtained 1 oz. 2 drs. of oil. This result is only approximative, as the quantity operated on was small. This shrub is rare in Victoria, and comparatively unproductive.

M. Squamosa.

This shrub produced the only green oil out of the group. Its odour is agreeable, resembling that of *M. Ericifolia*; taste disagreeable, and having the pungency usual to the tea tree oils. Yield only 5 drs. from 100 lbs.

The powers and use of these oils are next to be considered.

The camphoraceous odour more or less prevalent in them, together with their diffusible and penetrating effect on the palate, at once suggests their utility as solvents. It is well known that the solvent power of turpentine or spirit of wine is greatly increased by the addition of camphor, a principle which exists in all these oils. The oil of *E. Globulus,* in which camphor predominates, takes the first place as a solvent, and is closely followed by those of the same type. Resins of difficult solutions, such as copal, mastic, and amber, can be readily dissolved by these oils, *without the application of heat,* so as to form clear and elegant varnishes.

On the whole I do not think that a more profitable manufacture of native produce can be established at so small a cost in Victoria.

The native vegetation of Australia is strongly distinguished from that of other countries. Whilst travelling

through the bush, a cursory examination has often suggested to me the thought of the immense amount of valuable materials absolutely wasted for want of being represented to the public mind, so as to bring them into competition with the productions of other countries. Valuable as are the oils noticed in this paper, many products of probably equal value presented themselves during my investigations, nor have I the slightest doubt that further examination would establish them in a favourable position as articles of commerce.

The residual decoction from all the *Eucalypti*, after the expulsion of the volatile oil, consists of a bitter, extractive, and astringent principle, closely resembling a solution of the gum-resin exuding from the trees. This liquor, carefully manipulated, may produce the well-known "Terra Japonica," an article always in demand for tanning purposes.

The fresh leaves are inflammable, and even after the volatile oil has been extracted their inflammability is still very great. On examining these leaves after distillation we find a resinous coating covering each leaf; by digestion in spirit the resin is dissolved, and the spirit being removed the hard resin is left behind, which burns briskly. No doubt another volatile product could be obtained by the use of super-heated steam.

The green leaves, if left heaped together for one or two hours, generate a high temperature, and much of the volatile principle is thereby lost. Consequently, in working the materials for volatile oils, no time should be lost in subjecting them to distillation.

(N.B.—I have often thought they would be valuable to bush travellers during winter, as a small heap would make a warm and comfortable bed.)

We come now to the consideration of the Volatile Oils valuable in medicine, and the plants producing them. All the exhibited samples may very properly be placed here. The action and uses of the *Eucalypti* and *Melaleuca* internally may be considered as diffusive, stimulant, carminative, and anti-spasmodic. Applied externally they are valuable rubefacients.

I proceed to particularize several plants belonging to other genera, and yielding oils valuable in medicine.

Atherosperma Moschata, or Native Sassafras.

This tree ranks in Victoria (as at present known) as the most valuable for medicinal purposes. The bark and leaves supply us with two distinct essential oils. The inner rind

is very sweet, and smells much like new ale. A decoction from this part of the tree is a good substitute for yeast in raising bread. I have not yet been able to examine the roots.

In bronchial affections a decoction of the bark has been employed with beneficial effects; it is also a diuretic, a diaphoretic, and a sedative. I believe that Dr. Greeves was the first medical man in Victoria who employed it in medicine. The bark is very bitter, and the alkaloid obtained from it has been called "*Atherospermine.*" I am inclined to hazard the opinion that *Atherospermine* will prove serviceable in low colonial fevers.

The oil from the bark is heavier than water, of a pale straw colour when first distilled, deepening by age to a dark amber. It has an oppressive and disagreeable smell, resembling very much that of the Oil of Sassafras of commerce. Its taste is aromatic and bitter, producing a local pricking sensation on the tongue which lasts for some time. From 100 lbs. of the green bark I obtained 9 ozs. of oil. I obtained this oil about two years ago. On tasting it I found the action of the heart suddenly reduced so low that I was compelled to have recourse to powerful stimulants. I forwarded a supply to the Melbourne Hospital, stating its action, and it has since been employed in diseases of the heart, the dose being one or two drops every four or six hours.

The oil from the leaves is of a greenish colour, in smell much resembling oil of mace. Its other properties I have not yet been able to ascertain.

Prostanthera Lasianthos.

One of the "*Labiates,*" and forms in many parts of the colony part of the under-scrub vegetation. Yields by distillation an oil of a greenish yellow colour, in taste biting and mintish. Sp. gr. 0·912. Yield from 100 lbs. was 2 ozs. 4½ drs.

Prostanthera Rotundifolia.

This plant yields an oil but slightly different from the last mentioned. The yield from 100 lbs. was 12 ozs. Sp. grav. 0·941. These two are carminative.

Zieria Lanceolata.

The supply of oil from the leaves of this plant is tolerably copious, 100 lbs. of the green material producing 6½ ozs. The oil is of a pale yellow colour, and has an odour scarcely distinguishable from that of Oil of Rue. Its medicinal action may be considered similar to that of Rue.

Eriostemon Squameus.

The oil from this shrub is in all respects similar to that of *Z. Lanceolata.*

Mentha Australis.

This plant is a true mint. The oil produced is scarcely different from ordinary Oil of Peppermint, and would in this colony find a ready sale at 25s. per lb. Great differences as to purity and strength exist among imported oils of this character. From 100 lbs. I obtained 3 ozs.

Mentha Gravilis.

This herb contains a portion of its volatile oil in the stem ; the total yield from 100 lbs. of the green herb is 3 ozs. It is very similar to that yielded by *M. Australis.*

M. Grandiflora.

The oil of this species closely resembles that of *Pulegium.* The yield was 5 ozs. from 100 lbs. There can be no doubt that the oils of the genus *Mentha* here described are carminatives.

Of plants producing oils serviceable to the art of perfumery

Pittosporum Undulatum

Stands foremost. This is a beautiful shrubby tree, and produces blossoms of a charming fragrance. The essential oil or otto from the flowers is a limpid, colourless fluid, lighter than water, and of an exceedingly agreeable odour, much resembling the perfume of the jasmine. A few drops dissolved in silent spirit resemble many varieties of Eau de Cologne. The leaves yield a bitter extractive, well worthy of investigation.

Many of the *Eucalypti* and other oils already described, can be made useful for perfuming purposes. They form good basic odours, and can be materially altered as to aroma, on account of the readiness with which they yield up their own identity on the addition of essential oils in consonance with them.

It remains for me to notice briefly some particulars with regard to *imported* oil-producing plants, and to call attention to the probability of profitable results from their cultivation.

From the results of my investigations as stated in this paper, both as to the large number of native plants which produce essential oils, and the prolific yield of such oils from many of these plants, I inferred that the soil and climate of Victoria are peculiarly favourable to the growth of oil-producing plants. I therefore turned my attention for a

short time to imported oil-producing plants. I shall give the result as far as I was enabled to ascertain them.

Rue yields about 10 ozs. of oil from 100 lbs., Rosemary also yielded a large amount.

I obtained oil of a fine and beautiful aroma from many descriptions of geranium, but from the small amount of material within my reach I was unable to arrive at accurate conclusions.

Lavender gives half an ounce of oil from one pound of the spikes. Its aroma placed it in the medium class. I consider it worth in England 16s. per lb. This oil was obtained from plants on which no labour had been bestowed, and the soil on which they grew was poor and sandy.

There can be no doubt that fields of true peppermint, lavender, roses, and such plants, would prove highly remunerative. The results of all our investigations combine to establish the correctness of this assertion.

A market is always open for these productions, so that any quantity will find a ready sale.

I feel convinced therefore that a field is now opened up in this colony for the cultivation of such plants, and that this whole subject is well worthy the attention of the cultivators of the soil. And I am also convinced that the facts here stated ought to induce the Legislature to direct their attention more than ever to the enactment of such laws as shall tend to develope the resources of the colony.

Art. XVII.—*On Kerosene.* By the Hon. John Macadam, M.D., &c.

[Abstract of Paper, the Original read 8th September, 1862.]

The test of safety for kerosene is considered to be the temperature at which it takes fire permanently; that is, not when it emits a flash of flame, which, after flickering, is extinguished, but that when fired, it continues to burn until the portion tested is consumed.

The highest authorities have fixed this point of temperature at 130° Far. That any kerosene which ignites at a lower temperature than 130° Far. is deemed unsafe, in proportion to the number of degrees less than 130 at which it takes fire.

The test is a very simple one, the kerosene is placed in a small tin or porcelain saucer, this saucer is floated on boiling water,